

1 What is claimed is:

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3 1. A method of producing reduced-quality MPEG coded video from original-
4 quality MPEG coded video, the original-quality MPEG coded video including a set of
5 non-zero AC discrete cosine transform (DCT) coefficients for 8x8 blocks in frames of the
6 original-quality MPEG coded video, the reduced-quality MPEG coded video also having
7 frames of 8x8 blocks, each frame in the reduced-quality MPEG coded video having a
8 corresponding frame in the original-quality MPEG coded video, and each 8x8 block in
9 each frame of the reduced-quality MPEG coded video having a corresponding block in a
10 corresponding frame in the original-quality MPEG coded video, said method comprising
11 the steps of:

12 selecting non-zero AC DCT coefficients from corresponding blocks in the
13 original-quality MPEG coded video to be included in the blocks of the reduced-quality
14 MPEG coded video so that each 8x8 block in each frame of the reduced-quality MPEG
15 coded video has a number of bits encoding non-zero AC DCT coefficients that is
16 generally proportional to the number of bits encoding non-zero AC DCT coefficients for
17 the corresponding 8x8 block in the corresponding frame of original-quality MPEG coded
18 video.

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20 2. The method as claimed in claim 1, which includes computing a number of
21 bits available for encoding the non-zero AC DCT coefficients in said each of the 8x8
22 blocks in each frame of the reduced-quality MPEG coded video, the number of bits
23 available for encoding being computed by scaling the number of bits encoding non-zero
24 AC DCT coefficients in the corresponding block of the corresponding frame of the

1 original-quality MPEG coded video by a scale factor for said each frame, the scale factor
2 being selected to obtain a desired reduced bit rate in the MPEG coded video for said each
3 frame.

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5 3. The method as claimed in claim 2, which includes computing a moving
6 average of frame size of the frames in the original-quality MPEG coded video, and
7 computing the scale factor for said each frame from the moving average of frame size
8 and a desired frame size for the reduced-quality MPEG coded video.

9

10 4.. The method as claimed in claim 2, which includes computing a difference
11 between the number of bits available for encoding the non-zero AC DCT coefficients in
12 said each of the 8x8 blocks in each frame of the reduced-quality MPEG coded video and
13 the number of bits used for encoding the non-zero AC DCT coefficients retained in said
14 each of the 8x8 blocks in each frame of the reduce-quality MPEG coded video, and
15 making available for encoding non-zero AC DCT coefficients of following blocks said
16 difference between the number of bits.

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18 5. The method as claimed in claim 4, which includes accumulating said
19 difference to produce an accumulated number of bits that were available for encoding
20 non-zero AC DCT coefficients in prior 8x8 blocks of the reduced-quality MPEG coded
21 video but were not used for encoding non-zero AC DCT coefficients in the prior 8x8
22 blocks of the reduced-quality MPEG coded video, and making said accumulated number
23 of bits available for encoding non-zero AC DCT coefficients in a certain number of

1 following blocks in the reduced-quality MPEG coded video by dividing said accumulated
2 number of bits by said certain number of following blocks to compute a fraction of the
3 accumulated number of bits that is available for encoding said each of the 8x8 blocks of
4 said each frame of the reduced-quality MPEG coded video in addition to the number of
5 bits computed by scaling the number of bits encoding non-zero AC DCT coefficients in
6 the corresponding block of the corresponding frame of the original-quality MPEG coded
7 video by the scale factor for said each frame.

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9 6. The method as claimed in claim 5, wherein said certain number of blocks
10 is substantially equal to the number of blocks in said each frame, so that bits that are
11 available but not used for encoding the AC DCT coefficients for the blocks in said each
12 frame are made available for encoding the AC DCT coefficients for the blocks in a
13 following frame.

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15 7. The method as claimed in claim 1, which includes computing a difference
16 between a number of bits available for encoding the non-zero AC DCT coefficients in
17 said each of the 8x8 blocks in each frame of the reduced-quality MPEG coded video and
18 the number of bits used for encoding the non-zero AC DCT coefficients retained in said
19 each of the 8x8 blocks in each frame of the reduce-quality MPEG coded video, and
20 making said difference available for encoding non-zero AC DCT coefficients of
21 following blocks.

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1 8. The method as claimed in claim 7, which includes accumulating said
2 difference to produce an accumulated number of bits that were available for encoding
3 non-zero AC DCT coefficients in prior 8x8 blocks of the reduced-quality MPEG coded
4 video but were not used for encoding non-zero AC DCT coefficients in the prior 8x8
5 blocks of the reduced-quality MPEG coded video, and making said accumulated number
6 of bits available for encoding non-zero AC DCT coefficients in a certain number of
7 following blocks.

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9 9. The method as claimed in claim 8, wherein said accumulated number of
10 bits is made available for encoding non-zero AC DCT coefficients in a certain number of
11 following blocks of the reduced-quality MPEG coded video by dividing said accumulated
12 number of bits by said certain number of following blocks of the reduced-quality MPEG
13 coded video to compute a fraction of the accumulated number of bits that is available for
14 encoding non-zero AC DCT coefficients in said each of the 8x8 blocks of the reduced-
15 quality MPEG coded video in addition to the number of bits computed by scaling the
16 number of bits encoding non-zero AC DCT coefficients in the corresponding block of the
17 corresponding frame of the original-quality MPEG coded video by the scale factor for
18 said each frame.

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20 10. The method as claimed in claim 8, wherein said certain number of
21 following blocks is substantially equal to the number of blocks in a frame, so that bits
22 that are available but not used for encoding the AC DCT coefficients for the blocks in

1 said each frame are made available for encoding the AC DCT coefficients for the blocks
2 in a following frame.

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4 11. A method of producing reduced-quality MPEG coded video from original-
5 quality MPEG coded video, the original-quality MPEG coded video including a set of
6 non-zero AC discrete cosine transform (DCT) coefficients for 8x8 blocks in frames of the
7 original-quality MPEG coded video, the reduced-quality MPEG coded video also having
8 frames of 8x8 blocks, each frame in the reduced-quality MPEG coded video having a
9 corresponding frame in the original-quality MPEG coded video, and each 8x8 block in
10 each frame of the reduced-quality MPEG coded video having a corresponding block in a
11 corresponding frame in the original-quality MPEG coded video, said method comprising,
12 for each block in the reduced-quality MPEG coded video, the steps of:

13 (a) determining the number of bits used in encoding non-zero AC DCT
14 coefficients in the corresponding block of original-quality MPEG coded video;

15 (b) computing a number of bits available for encoding AC DCT coefficients in the
16 original-quality MPEG coded video by scaling the number of bits used in encoding non-
17 zero AC DCT coefficients in the corresponding block of original-quality MPEG coded
18 video with a scale factor; and

19 (c) selecting non-zero AC DCT coefficients in a certain order from the
20 corresponding block in the original-quality MPEG coded video to be included in said
21 each block of the reduced-quality MPEG coded video until the number of bits available
22 for encoding the AC DCT coefficients in the block in the reduced-quality encoded video
23 is not sufficient for encoding, in the block of the reduced-quality MPEG coded video, any

1 more of the AC DCT coefficients in the corresponding block of original-quality MPEG
2 coded video.

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4 12. The method as claimed in claim 11, wherein said order is a parsing order
5 of the non-zero AC DCT coefficients in the corresponding block in the original-quality
6 MPEG coded video.

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8 13. The method as claimed in claim 11, which includes computing the scale
9 factor from a bit rate of the original-quality MPEG coded video and a desired bit rate for
10 the reduced-quality MPEG coded video.

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12 14. The method as claimed in claim 11, which includes computing the scale
13 factor for each frame of the reduced-quality MPEG coded video from a moving average
14 of the size of the corresponding frames in the original-quality MPEG coded video and a
15 desired frame size for the reduced-quality MPEG coded video.

16

17 15. The method as claimed in claim 11, which includes computing a
18 difference between the number of bits available for encoding the non-zero AC DCT
19 coefficients in said each of the 8x8 blocks in each frame of the reduced-quality MPEG
20 coded video and the number of bits used for encoding the non-zero AC DCT coefficients
21 retained in said each of the 8x8 blocks in each frame of the reduce-quality MPEG coded
22 video, and making available for encoding non-zero AC DCT coefficients of following
23 blocks said difference between the number of bits.

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2 16. The method as claimed in claim 15, which includes accumulating said
3 difference to produce an accumulated number of bits that were available for encoding
4 non-zero AC DCT coefficients in prior 8x8 blocks of the reduced-quality MPEG coded
5 video but were not used for encoding non-zero AC DCT coefficients in the prior 8x8
6 blocks of the reduced-quality MPEG coded video, and making said accumulated number
7 of bits available for encoding non-zero AC DCT coefficients in a certain number of
8 following blocks in the reduced-quality MPEG coded video by dividing said accumulated
9 number of bits by said certain number of following blocks to compute a fraction of the
10 accumulated number of bits that is available for encoding said each of the 8x8 blocks of
11 said each frame of the reduced-quality MPEG coded video in addition to the number of
12 bits computed by scaling the number of bits encoding non-zero AC DCT coefficients in
13 the corresponding block of the corresponding frame of the original-quality MPEG coded
14 video by the scale factor for said each frame.

15
16 17. The method as claimed in claim 16, wherein said certain number of
17 following blocks is substantially equal to the number of blocks in said each frame, so that
18 bits that are available but not used for encoding the AC DCT coefficients for the blocks
19 in said each frame are made available for encoding the AC DCT coefficients for the
20 blocks in a following frame.

21
22 18. A method of producing in real-time a stream of reduced-quality MPEG-2
23 coded video from a source of original-quality MPEG-2 coded video, the original-quality

1 MPEG-2 coded video including a set of non-zero AC discrete cosine transform (DCT)
2 coefficients for 8x8 blocks in frames of the original-quality MPEG-2 coded video, the
3 reduced-quality MPEG-2 coded video also having frames of 8x8 blocks, each frame in
4 the reduced-quality MPEG-2 coded video having a corresponding frame in the original-
5 quality MPEG-2 coded video, and each 8x8 block in each frame of the reduced-quality
6 MPEG-2 coded video having a corresponding block in a corresponding frame in the
7 original-quality MPEG-2 coded video, said method comprising, for each frame in the
8 reduced-quality MPEG-2 coded video, the steps of:

9 (a) computing a moving average of the size of the corresponding frame in the
10 original-quality MPEG-2 coded video;

11 (b) computing a scale factor from the moving average of the size of the
12 corresponding frame in the original-quality MPEG-2 coded video and a desired size of
13 said each frame of the reduced-quality MPEG-2 coded video; and

14 (c) for each 8x8 block in said each frame:

15 (i) determining the number of bits used in encoding non-zero AC DCT
16 coefficients in the corresponding block of original-quality MPEG-2 coded video;

17 (ii) computing a number of bits available for encoding AC DCT
18 coefficients in the original-quality MPEG-2 coded video by scaling the number of
19 bits used in encoding non-zero AC DCT coefficients in the corresponding block
20 of original-quality MPEG-2 coded video with a scale factor, and

21 (iii) selecting non-zero AC DCT coefficients in a parsing order from the
22 corresponding block in the original-quality MPEG-2 coded video to be included
23 in said each block of the reduced-quality MPEG-2 coded video until the number

1 of bits available for encoding the AC DCT coefficients in the block in the
2 reduced-quality encoded video is not sufficient for encoding, in the block of the
3 reduced-quality MPEG-2 coded video, any more of the AC DCT coefficients in
4 the corresponding block of original-quality MPEG-2 coded video.

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6 19. The method as claimed in claim 18, which includes computing a
7 difference between the number of bits available for encoding the non-zero AC DCT
8 coefficients in said each of the 8x8 blocks in each frame of the reduced-quality MPEG
9 coded video and the number of bits used for encoding the non-zero AC DCT coefficients
10 retained in said each of the 8x8 blocks in each frame of the reduce-quality MPEG coded
11 video, and making available for encoding non-zero AC DCT coefficients of following
12 blocks said difference between the number of bits.

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14 20. The method as claimed in claim 19, which includes accumulating said
15 difference to produce an accumulated number of bits that were available for encoding
16 non-zero AC DCT coefficients in prior 8x8 blocks of the reduced-quality MPEG coded
17 video but were not used for encoding non-zero AC DCT coefficients in the prior 8x8
18 blocks of the reduced-quality MPEG coded video, and making said accumulated number
19 of bits available for encoding non-zero AC DCT coefficients in a certain number of
20 following blocks in the reduced-quality MPEG coded video by dividing said accumulated
21 number of bits by said certain number of following blocks to compute a fraction of the
22 accumulated number of bits that is available for encoding said each of the 8x8 blocks of
23 said each frame of the reduced-quality MPEG coded video in addition to the number of

1 bits computed by scaling the number of bits encoding non-zero AC DCT coefficients in
2 the corresponding block of the corresponding frame of the original-quality MPEG coded
3 video by the scale factor for said each frame.

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5 21. The method as claimed in claim 20, wherein said certain number of blocks
6 is substantially equal to the number of blocks in said each frame, so that bits that are
7 available but not used for encoding the AC DCT coefficients for the blocks in said each
8 frame are made available for encoding the AC DCT coefficients for the blocks in a
9 following frame.

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